

**ANNUAL RESEARCH REPORT**  
**FY 2014**  
**February 2015**

**1. Title:**

Demographic Characteristics and Ecology of Northern Spotted Owls (*Strix occidentalis caurina*) in the Southern Oregon Cascades.

**2. Principal Investigators and Organizations:**

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Biologists: L. Steven Andrews (Project Leader), J. Brooks, T. Burnett, E. Fleigel, L. Friar, T. Phillips, and T. Tippin, Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon.

**3. Study Objectives:**

- a. Estimate population parameters (proportion of territories where owls were detected, fecundity, survival rates, and annual rates of population change) and occupancy dynamics of northern spotted owls on the Rogue River-Siskiyou and Fremont-Winema National Forests.
- b. Examine northern spotted owl diets, nesting habitat, and interspecific interactions with barred owls.
- c. Communicate results to other researchers examining northern spotted owl ecology.

**4. Potential Benefit or Utility of the Study:**

Studying the population dynamics, diet and habitat characteristics associated with spotted owls during their breeding season will increase our understanding of factors affecting spotted owl populations. This study offers insights into spotted owl ecology while concurrently addressing the validation and effectiveness monitoring requirements of the Northwest Forest Plan (USDA and USDI 1994). The Southern Oregon Cascades Study Area (CAS) is one of eight Federally-sponsored study areas that represent the Effectiveness Monitoring Program for Spotted Owls under the Northwest Forest Plan (Lint et al. 1999). Demography data from this study area has been included in six meta-analyses of spotted owl vital rates across the species range (Anderson and Burnham 1992, Burnham et al. 1994, 1996, Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011, Dugger et al. *In prep*). These data were important for the 2004 review of the species' threatened status (USFWS 2004), the Revised Recovery Plan for the Northern Spotted Owl, the Designation of Revised Critical Habitat for the Northern Spotted Owl, and the Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls Final Environmental Impact Statement (USDI 2008, 2011, 2012, 2013).

## 5. Study Description and Survey Design:

The design of this project follows the framework of a demographic study that monitors a collection of known owl sites within a bounded area. To meet the objectives of this study, we gathered annual data that allowed us to periodically estimate survival, reproductive rates, and annual rate of population change, as well as occupancy dynamics (Wagner et al. 1996, Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2011, Dugger et al. *In prep.*). This study utilized a sample of northern spotted owls within Late-Successional Reserve (LSR), Matrix Land-use Allocations (LUA) (USDA and USDI 1994) and Wilderness Areas. We followed survey protocol and data collection procedures as outlined in Forsman (1995).

## 6. Study Area

The CAS incorporates approximately 2,400 km<sup>2</sup> of primarily Federal forest land. The area is geographically situated on lands administered by the Rogue River-Siskiyou National Forest (High Cascades Ranger District), the Fremont-Winema National Forest (Klamath Ranger District), and the Umpqua National Forest (Diamond Lake Ranger District) (Figure 1). The study area occupies the southern terminus of the Oregon Cascades including portions of both the western and eastern provinces. Landforms are primarily volcanic in origin and consist of plateaus and moderately dissected terrain (USDA and USDI 1994). The study area lies within the Mixed-Conifer, *Abies concolor*, *Abies magnifica* var. *shastensis*, and *Tsuga mertensiana* zones at elevations ranging from 900-2000 meters (Franklin and Dyrness 1973).

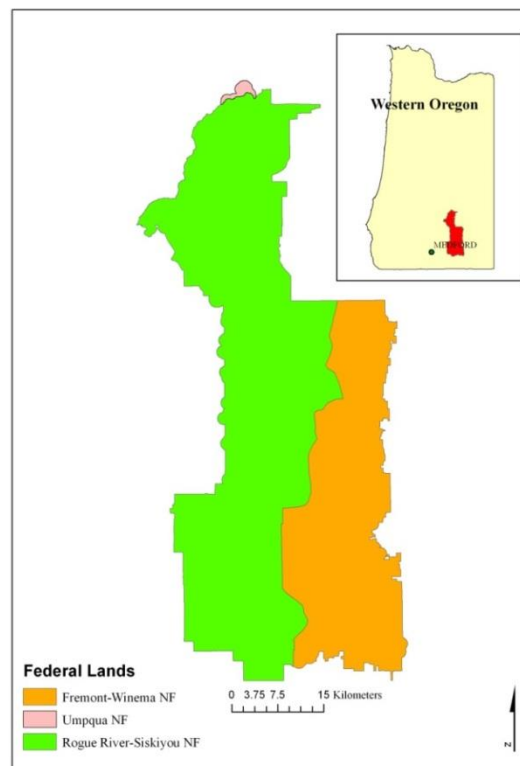


Figure 1. The Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

There are 90 sites within the boundaries of the study that have been surveyed continuously from 1992 to 2014 and this subset of owl territories were among those used to estimate the annual rate of population change in the last 3 meta-analyses (Anthony et al. 2006, Forsman et al. 2011, Dugger et al. *In prep.*).

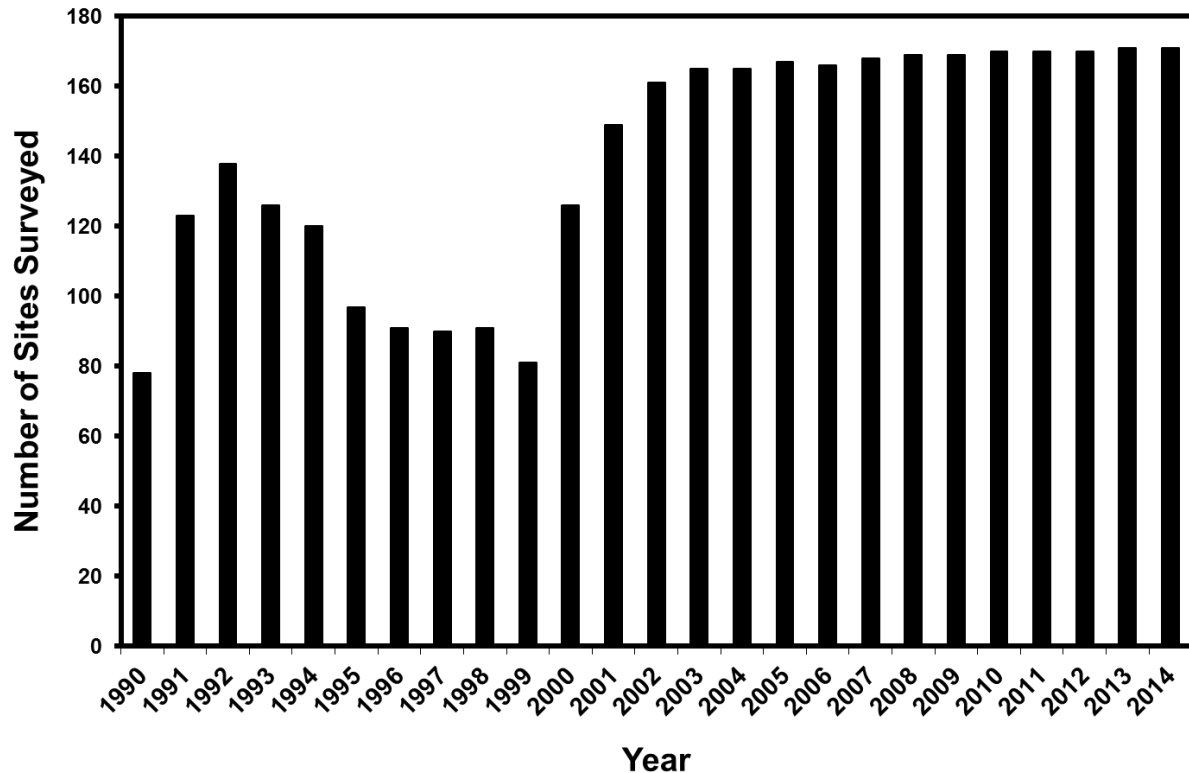


Figure 2. The number of historic spotted owl territories surveyed annually on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

An important component of the CAS area is the Late-successional Reserves: Rogue-Umpqua Divide (LSR 225), Middle Fork (LSR 226), Dead Indian (LSR 227), Clover Creek (LSR 228), and Sevenmile Creek (LSR 229). Of these, Rogue-Umpqua Divide, Middle Fork, and Dead Indian are large encompassing 16,050, 20,080, and 41,310 ha, respectively, and projected to support 15-20 pairs of owls (USDA 1998). Clover Creek and Sevenmile Creek LSRs are smaller, incorporating 1,130 and 3,710 ha (USDA 1997). The LSRs are situated entirely within the study area. Dead Indian LSR spans the crest of the southern Oregon Cascades and is jointly administered by the Rogue River-Siskiyou and Fremont-Winema National Forests. Three Congressionally Reserved Wilderness Areas are also located within the study area. Owl territories were found in the Sky Lakes (45,800 ha), Mountain Lakes (9,300 ha) and a portion of the Rogue-Umpqua Divide Wilderness Areas (2,064 ha) (Figure 3).

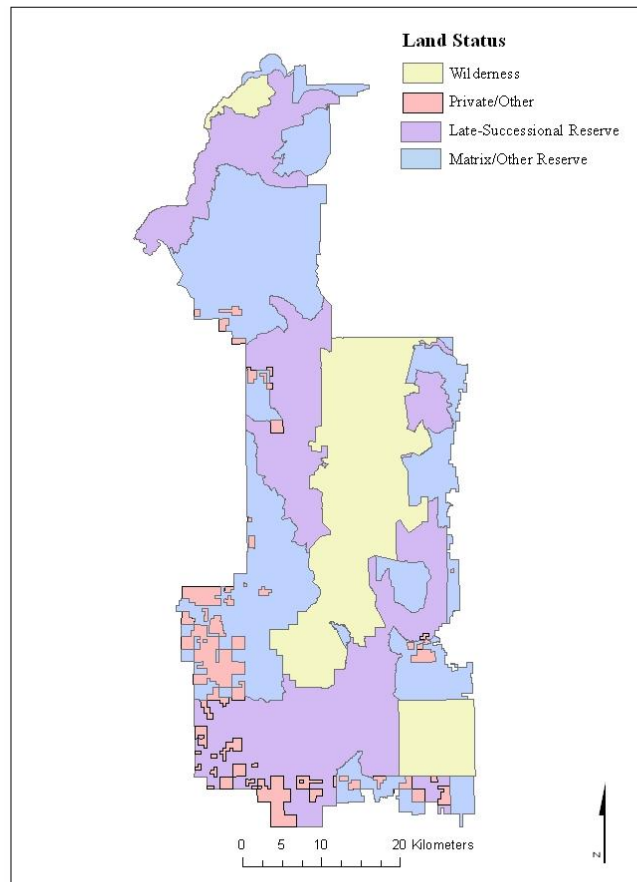


Figure 3. Land-use Allocations within the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

## 7. **Research Accomplishments:**

### **Proportion of territories where spotted owls were detected**

Spotted owls were detected at 53 of the 171 sites we visited in 2014 (Figure 4). Among the sites that were surveyed to protocol, pairs were detected at 36 sites, single owls were detected at 5 sites, and owls of unknown social status were detected at 12 sites (Appendix 1). The percentage of sites where spotted owls were detected on the study area (31%) represented a 4.0% decrease from 2013 ( $\bar{x} = 65.9\%$ ,  $SE = 3.88$ ,  $n = 25$  years), with the percent of pairs located (21%) equaling 2013 ( $\bar{x} = 51.0\%$ ,  $SE = 3.51$ ,  $n = 25$  years). There were 90 sites with continuous survey effort between 1992 and 2014, and banded spotted owls were detected at 24% of these sites in 2014 ( $\bar{x} = 51.3\%$ ,  $SE = 3.48$ ,  $n = 23$  years).

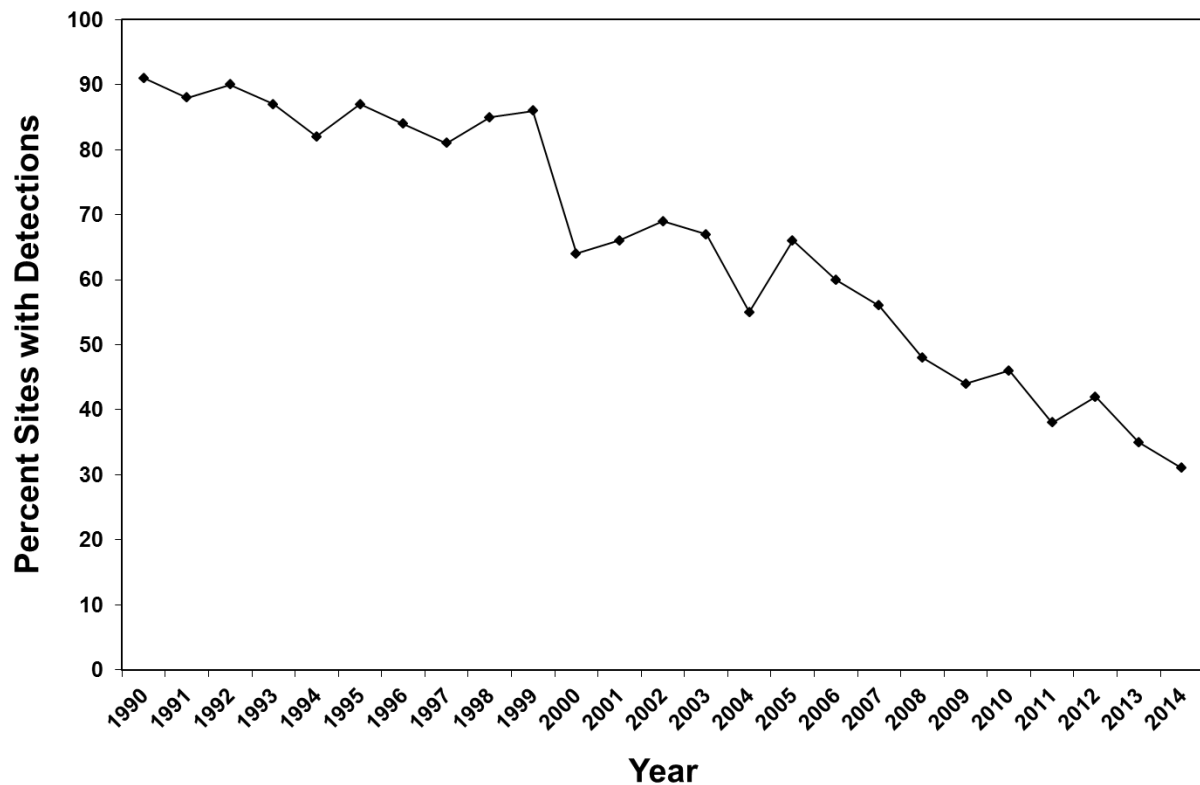


Figure 4. Percentage of all sites surveyed annually with  $\geq 1$  spotted owl detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

Spotted owls were detected at 5 Wilderness, 34 LSR, and 14 Matrix sites in 2014 (Appendix 2). The percentage of sites where spotted owls were detected (either single or paired) in Wilderness decreased from 33% in 2013 to 32% ( $\bar{x} = 55.5\%$ ,  $SE = 4.97$ ,  $n = 18$  years), and the percentage of sites where pairs were located was 28% ( $\bar{x} = 44.3\%$ ,  $SE = 4.66$ ,  $n = 18$  years). In the LSRs, the percentage of sites where owls were detected was unchanged from 2013 at 34% ( $\bar{x} = 59.4\%$ ,  $SE = 3.79$ ,  $n = 18$  years), and the percentage of sites where owl pairs were detected was 19% ( $\bar{x} = 44.6\%$ ,  $SE = 3.76$ ,  $n = 18$  years). Owls were detected on 26% of Matrix owl territories in 2014, a decline of 11% from 2013 ( $\bar{x} = 55.9\%$ ,  $SE = 4.44$ ,  $n = 18$  years), with pairs located at 22% of Matrix sites in 2014 ( $\bar{x} = 44.4\%$ ,  $SE = 4.28$ ,  $n = 18$  years). Overall, the mean percentage of sites with owls detected has remained similar for the Wilderness and LSR, although a gradual decline is evident on both areas. In 2014 the decline in sites where spotted owls were detected in the Matrix was greater than for most years. The mean percentage of sites with pairs is similar for the three land management categories and increased for Wilderness sites in 2014 compared to 2013 (Appendix 2).

### Breeding Propensity

Twenty-six owl pairs were surveyed to protocol to determine nesting status (i.e., proportion of pairs that attempted to nest each year; Forsman 1995), and 22 of these pairs exhibited nesting behavior (85%) which was among the highest nesting rates recorded for this study. On average,

54% (SE = 5.03, n = 25 years; min. = 3%; max = 86%) of pairs detected each year attempted to nest. All owl pairs confirmed to be nesting (by June 1<sup>st</sup> for sites < 1371m. and June 15<sup>th</sup> for sites ≥ 1371m. in elevation) in 2014 fledged young. The mean rate of nest failure for pairs determined to be nesting in all years (1990-2014; n = 25) was 15% (SE = 1.93; min. = 0.0, max. = 26.9).

By the end of the field season, 36 pairs were confirmed at sites where owls were detected, and 28 of these, including pairs not surveyed to protocol for nesting status determination (i.e., located for the first time after June 1 or June 15, 2014), successfully reproduced ( $\bar{x}$  = 24.1, SE = 3.04, n = 25 years; min. = 1; max. = 56). The average number of young fledged per confirmed breeding pair in 2014 (1.34) was greater than the mean for all years ( $\bar{x}$  = 0.69, SE = 0.084, n = 25 years) (Figure 5). The number of young produced per successful pair (1.68) in 2014 was similar to the average during the study ( $\bar{x}$  = 1.60, SE = 0.042, n = 25 years) (Appendix 3).

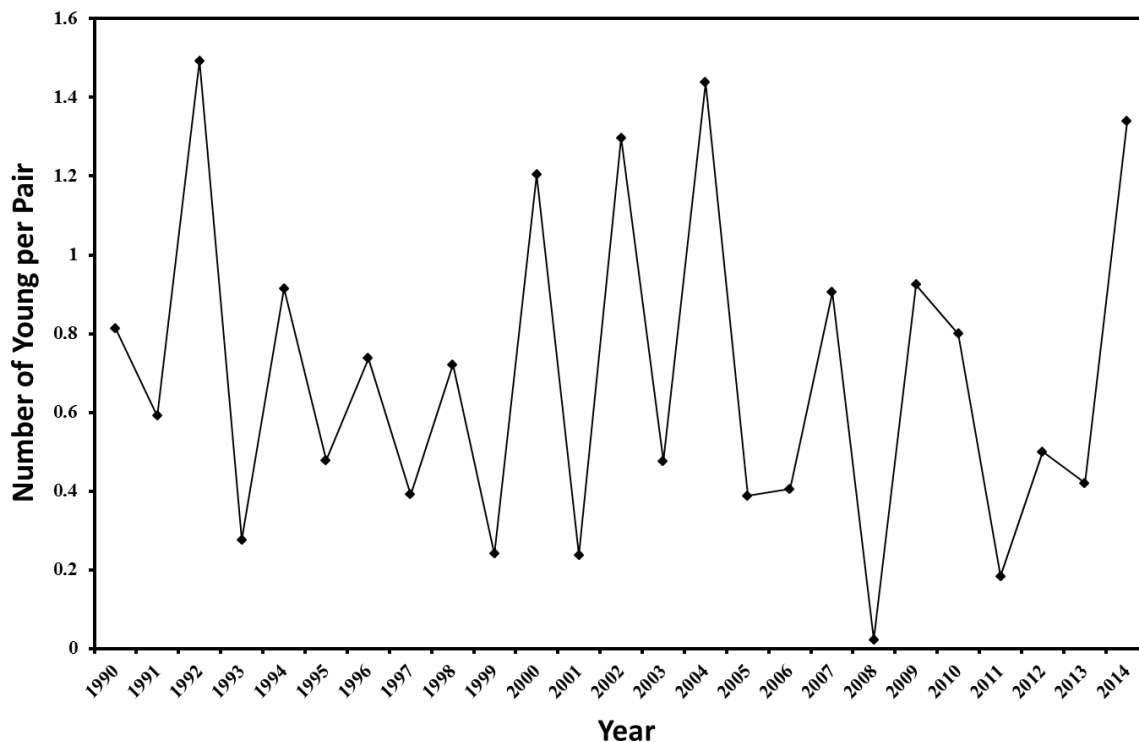


Figure 5. The number of young produced per total number of sites where spotted owl pairs were detected when surveyed to protocol for reproduction on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

In 2014, the average number of fledglings per pair in the LSRs was 1.58, 1.25 in the Matrix and 0.50 in the Wilderness. Between 1997 and 2014 the average number of young produced per pair in Matrix ( $\bar{x}$  = 0.67 SE = 0.093, n = 18 years; min. = 0.00, max. = 1.46) and LSRs ( $\bar{x}$  = 0.69, SE = 0.113, n = 18 years; min. = 0.04, max. = 1.58) have been similar and slightly better than in Wilderness areas ( $\bar{x}$  = 0.47, SE = 0.131, n = 18 years; min. = 0.0, max. = 1.67) (Appendix 4).

We calculated productivity as the mean number of young fledged per female monitored for reproductive success (NYF). The mean NYF for females located in 2014 (age classes combined) on territories in the LSR was 1.50 ( $\bar{x} = 0.677$ ,  $SE = 0.110$ ,  $n = 18$  years, min. = 0.04, max. = 1.50), 1.25 ( $\bar{x} = 0.651$ ,  $SE = 0.088$ ,  $n = 18$  years, min. = 0.00, max. = 1.32) for territories in the Matrix, and 0.50 for territories in the Wilderness ( $\bar{x} = 0.459$ ,  $SE = 0.132$ ,  $n = 18$  years, min. = 0.00, max. = 1.71) (Appendix 4). Over the course of the study, annual mean NYF for female spotted owls located at territories in the LSR and Matrix tended to be greater than for Wilderness sites. Overall, average NYF was 1.31 ( $SE = 0.143$ ,  $n = 36$ ) for all females (ages combined) in 2014 ( $\bar{x} = 0.68$ ,  $SE = 0.083$ ,  $n = 25$  years; min. = 0.02, max. = 1.49) (Figure 6).

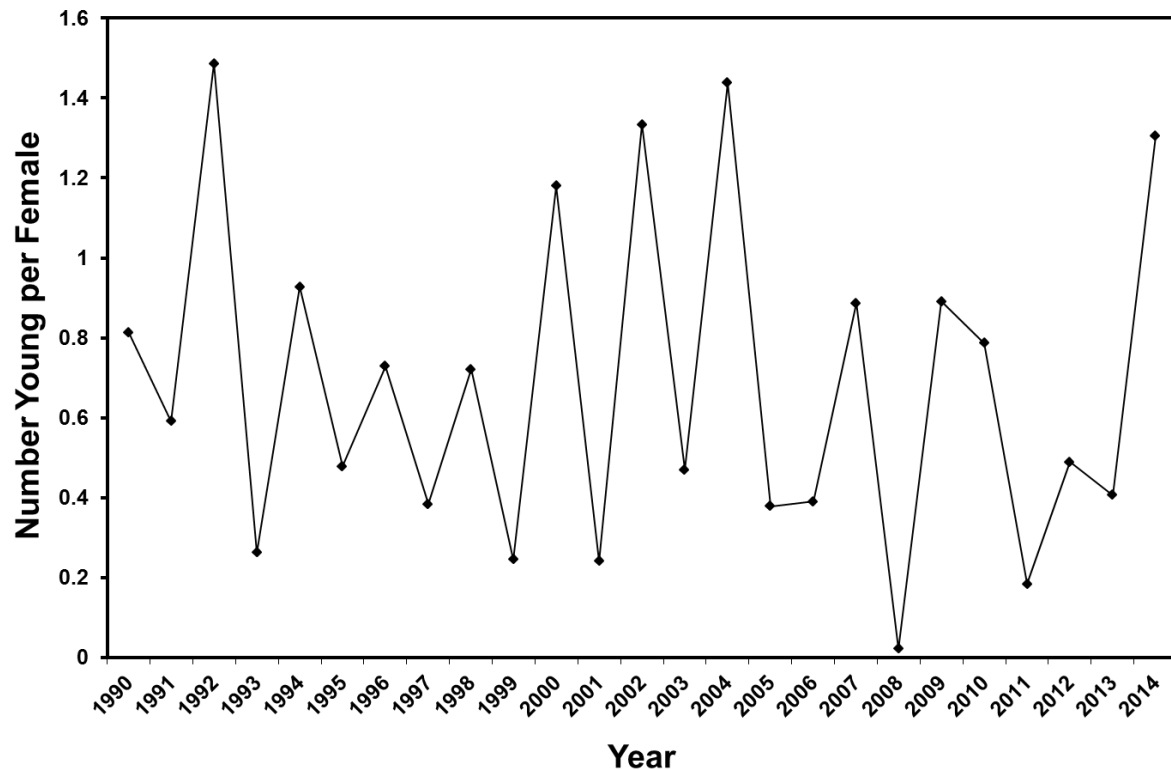


Figure 6. The mean annual number of young fledged (NYF ) per female spotted owl surveyed to protocol for reproduction on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

### Age and Sex Composition

In 2014 there were 92 non-juvenile owls detected ( $\bar{x} = 160.1$ ,  $SE = 7.4$ ,  $n = 25$  years), with 50 males, 41 females and 1 sex unknown; this was the fewest number of owls detected during the study (Appendix 5). On average 46% of the owls detected each year on the study area are females, and the percentage of females in 2014 equaled 45% (Appendix 5). The ratio of female to male owls has exhibited annual variation (Figure 7).

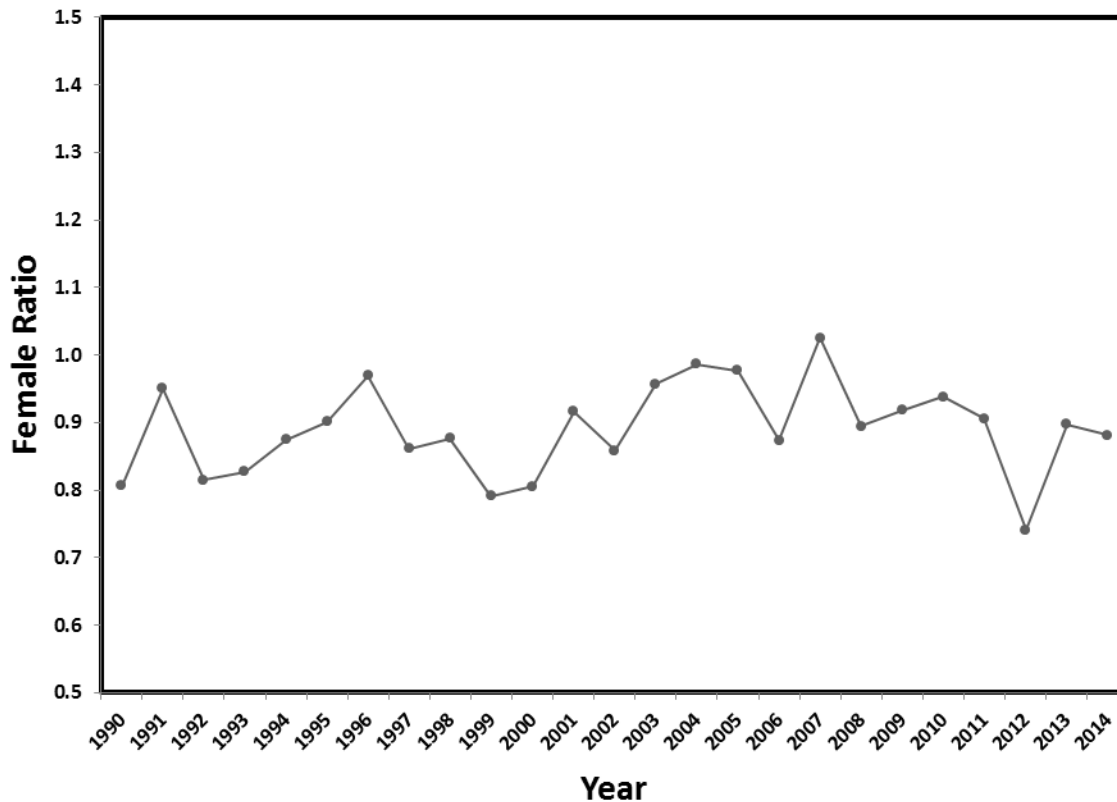


Figure 7. Ratio of female to male spotted owls on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

There were 80 owls which we could assign to an age class in 2014 with 92.4% as adults ( $\geq 3$  years old) and 7.5% as subadults (Appendix 5). There were 6 subadults located (2 females and 4 males), which is less than the average for all years ( $\bar{x} = 8.5$ ,  $SE = 0.90$ ; min. = 2, max. = 19,  $n = 25$  years). We could not ascertain the age of 12% of the study population which is less than the average for all years ( $\bar{x} = 18.4\%$ ,  $SE = 2.50$ ,  $n = 25$  years). The majority of unknown aged owls represented auditory detections usually during nighttime surveys without visual observation.

### Banding and Resighting

In 2014, we banded 41 owls (35 fledglings, 3 subadults and 3 adults) on the study area and a total of 54 banded non-juvenile owls of known identity (including newly banded owls) were seen at least once during the season, a decline of nearly 5% from 2013 (Appendix 6). Territorial females (initially captured as juveniles, 1<sup>st</sup> year or 2<sup>nd</sup> year subadults) of known age averaged 9.4 years ( $SE = 1.15$ ,  $n = 15$ ; min. = 2, max. = 17) and known-age territorial males averaged 8.3 years ( $SE = 1.23$ ,  $n = 12$ ; min. = 1, max. = 13) for males. The oldest owl we observed was at minimum 19 years of age as he was banded as an adult of unknown age, so a minimum of 3 years old in 1998.

There were 5 documented inter-territory movements of banded owls in 2014 on the demographic study area. Two owls banded as juveniles (2010 and 2012) were located at non-natal sites within the study area, and 3 owls previously banded as adults were relocated on new territories within the study area.



A total of 198 movements have been recorded on the study area from 1990-2014 and the mean movement distance was 16.1 km for females (SE = 1.84, n = 88; min. = 0.4, max. = 88.0) and 8.8 km (SE = 0.87, n = 110; min. = 0.8, max. = 44.2) for males.

## Barred Owls

The range of northern barred owls (*Strix varia*) has expanded during the last century and now overlaps that of the northern spotted owl (Livezey 2009, Wiens et al. 2014). Barred owls were first detected within the boundaries of the CAS in 1981 (*Pers. comm.* Rick Hardy, Wildlife Biologist (Ret.), U.S. Forest Service). This study was not designed to systematically follow trends in barred owl occupancy but it has gathered a significant number of incidental detections of barred owls during the course of spotted owl surveys. The annual percentage of barred owl detections at the 171 spotted owl territories on the study has increased from a low of 4.1% to a high of 38% in 2014 (Figure 8). Cumulatively, barred owls have been detected at 77% of the spotted owl territories during at least one breeding season over the course of this study. The annual proportion of surveyed areas with spotted owl detections exhibits a strong negative association with the cumulative proportion of surveyed areas with barred owl detections ( $r = -0.94$ ,  $p \leq 0.001$ ). This proportion is likely still an underestimate of the number of spotted owl territories being influenced by barred owls, as some barred owls are probably missed during surveys for spotted owls. However, a study in the Oregon Coast range suggests that over the course of a season, spotted owl surveys to protocol ( $\geq 3$  visits) allow ~85% of the barred owls present in the area to be detected (Wiens et al. 2011). In addition, we have been able to document the strong negative effects of barred owl detections on spotted owl detection rates, as well as extinction and colonization rates on this study area (Dugger et al. 2011).

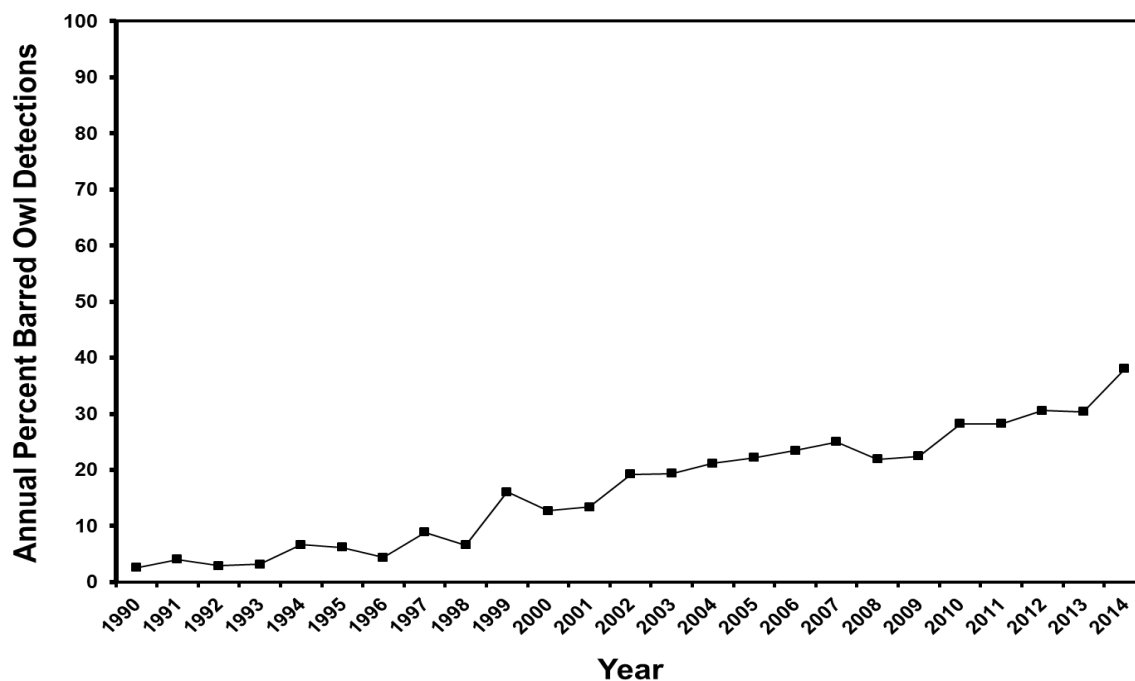


Figure 8. The annual percentages of historic spotted owl territories surveyed where barred owls were detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014.

## Spotted Owl Diets

A total of 6,501 prey specimens from 118 owl sites in regurgitated pellets were collected and identified during 2000-2013, with more as yet unprocessed, pellets collected in 2014. Samples were collected opportunistically at spotted owl nesting or roosting sites with most pellets collected from breeding spotted owls. The sample consists primarily of northern flying squirrels (*Glaucomys sabrinus*), woodrat species (*Neotoma cinerea* and *N. fuscipes*) and Lagomorphs (Figure 9).

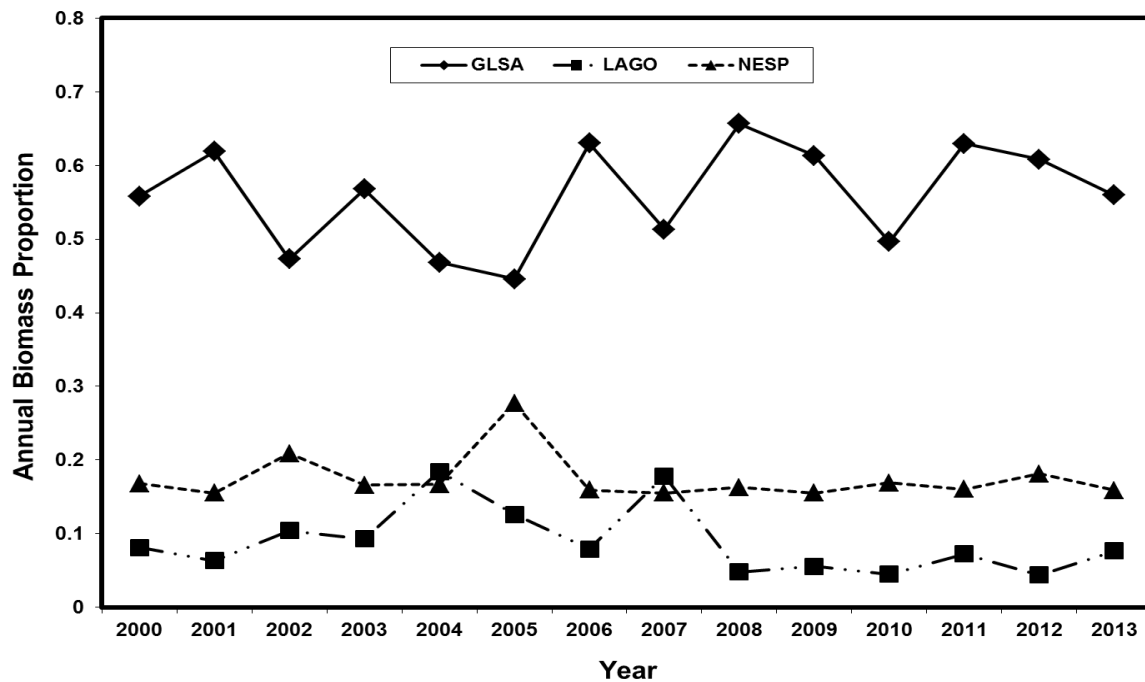


Figure 9. The annual biomass proportion of flying squirrels (GLSA = *Glaucomys sabrinus*), woodrats (NESP = *Neotoma* species) and Lagomorphs (LAGO) in regurgitated spotted owl pellets on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 2000-2013

Pocket gophers (*Thomomys mazama* and *T. talpoides*), red-backed voles (*Myodes californicus*) and moles (*Scapanus orarius* and *S. latimus*) in pellets were low in biomass but higher in absolute numbers (Figure 10).

We are currently investigating the relationship of prey remains in spotted owl pellets to spatial and temporal covariates at spotted owl territories using a multi-state occupancy approach.

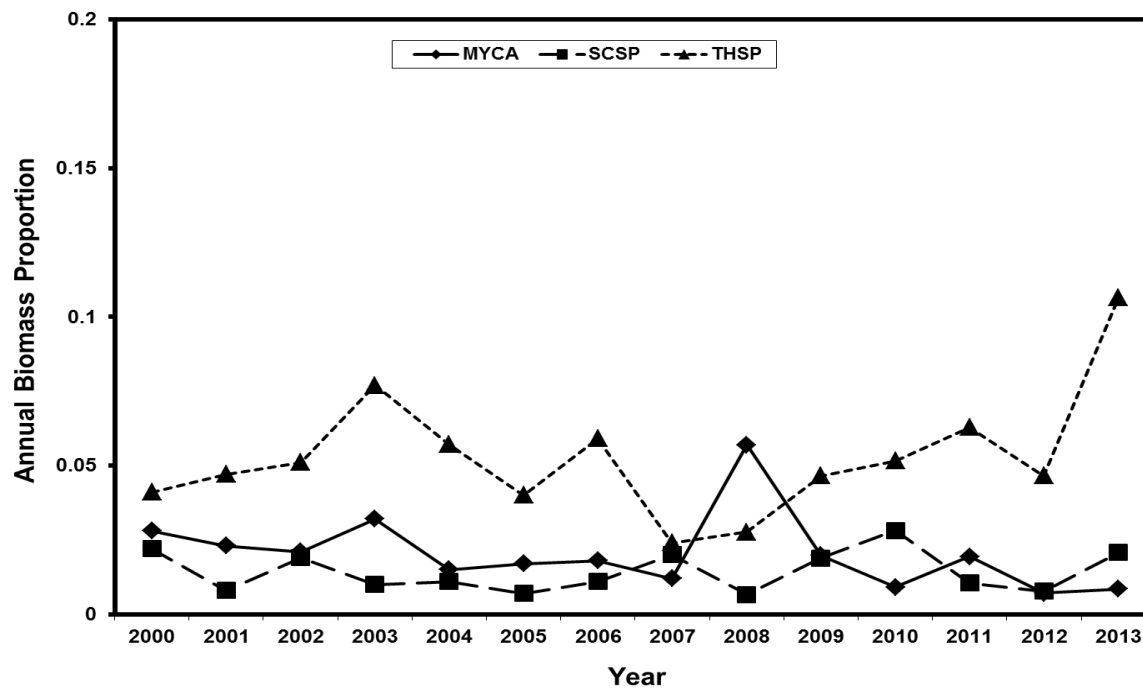


Figure 10. The annual biomass proportion of western red-backed voles (MYCA = *Myodes californicus*), moles (SCSP = *Scapanus* species) and pocket gophers (THSP = *Thomomys* species) in regurgitated spotted owl pellets on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 2000-2013.

## Survey Effort

By 1994 more than 90% of the sites currently visited in the demographic study had been identified. The number of visits conducted to spotted owl territories on the study area varies between years based on the requirements of the survey protocol relative to detecting single owls and pairs, and determining annual productivity. The proportion of day and night visits is also influenced by snowpack with more night visits being conducted in years where early season access to owl sites is limited. The majority of the visits required to determine whether an owl was present on a site are conducted as nighttime surveys. From 1994 to 2014, as the proportion of territories where owls are detected has declined, the amount of survey effort dedicated to productivity assessments has also declined and the effort for determining whether owls are present or not, has gradually increased (Figure 11). Across all visits, the proportion of nighttime surveys has varied annually but has gradually increased (min. = 24%; max. = 66%) (Figure 11).

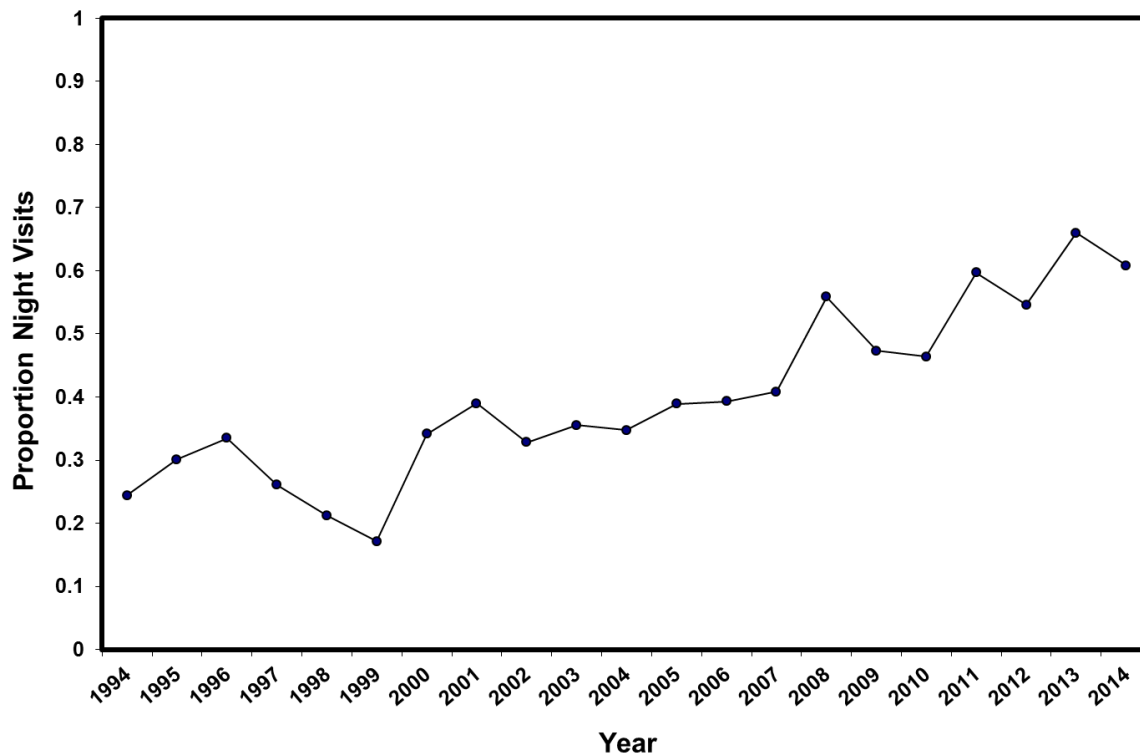


Figure 11. The annual proportion of total visits conducted as nighttime surveys of historic spotted owl territories on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1994-2014.

## 2014 meta-analysis

A workshop was conducted to analyze range-wide demographic data of northern spotted owls in January 2014 (Dugger et al. *In prep.*). The workshop was held as a requirement of the *Northern Spotted Owl Effectiveness Monitoring Plan for the Northwest Forest Plan* (Lint et al. 1999), and was the sixth in a series of demographic workshops that were convened initially in 1991 (Anderson and Burnham 1992), again in 1993 (Burnham et al. 1994, 1996), and then every five years since 1993 (1998: Franklin et al. 1999; 2004: Anthony et al. 2006; 2009: Forsman et al. 2011). Status and trends in apparent survival, fecundity, rate of population change and occupancy dynamics, as well as the factors that affect these vital rates were investigated for each individual study area, as well as all 11 study areas combined (e.g., Anthony et al. 2006, Forsman et al. 2011). Data from this study area was prepared and submitted for inclusion in the analysis, and L.S. Andrews participated in the workshop. Results from the workshop for this study area and 10 others across the range of the northern spotted owl are in preparation, with publication expected sometime in 2015 (Dugger et al. *In prep.*).

## Discussion

In 2014 field work was aided by a very low snow pack and mild temperatures which improved our access to all sites though out the study area. As in 2013, the ease of access permitted us to begin a schedule of swing shifts with night work at the onset of the field season. It would be expected that the detection rates of spotted owls might be improved by the addition of early

season night surveys for both 2013 and 2014. However, despite our more extensive night time survey effort in the spring, the number of sites where spotted owls were detected in the last two years has been the lowest ever recorded.

In 2014 productivity increased relative to 2013 and was greater than in most years. Warmer temperatures in the early nesting season are associated with increased productivity while increased precipitation during winter is associated with lower productivity in the southern Oregon Cascades (Dugger et al. 2005, Forsman et al. 2011). Productivity in 2014 was better than average and early nesting season temperatures were higher than the average while precipitation during the winter was at, or near, record lows (<http://www.accuweather.com>), so the mild weather might have been a factor in the high nest success that we documented. During the course of the study productivity has periodically followed a strong biannual pattern of alternating high and low years, disrupted by low productivity in both 2005-2006 and higher reproduction in both 2009-2010. The annual total number of young produced on the study area generally declined or increased slightly in the previous six years so 2014 represented a large departure from the recent pattern.

The total number of spotted owls detected and the number of previously banded owls identified in 2014 were the lowest recorded for the study. Spotted owl detections at historic territories were unchanged from 2013-2014 at LSR sites, whereas, the double digit decrease in spotted owl detections in the Matrix LUA well exceeded the slight decrease in detections recorded for the Wilderness sites. Overall this has been the long-term trend across the study area as detections of spotted owls has gradually declined.

## **8. Acknowledgments:**

We would like to acknowledge the many individuals who have also contributed to the success of this project, including: Eric Forsman (Wildlife Biologist (Ret.), Pacific Northwest Research Station), Ray Davis (Old Forest and Northern Spotted Owl Monitoring Lead, Interagency Regional Monitoring Team), Dave Clayton (Forest Wildlife Biologist, Rogue River-Siskiyou National Forest), Amy Markus (Forest Wildlife Biologist, Fremont-Winema National Forest), Sheila Colyer (Wildlife Biologist, High Cascades Ranger District, Rogue River-Siskiyou National Forest), Lisa Lyon (Wildlife Biologist, South Zone, Fremont-Winema National Forest), Jeff Von Kienast (Wildlife Biologist, High Cascades Ranger District, Rogue River-Siskiyou National Forest), Steve Hayner (Wildlife Biologist, Klamath Falls Resource Area, Lakeview District BLM), Robin Snider (District Wildlife Biologist, Medford District BLM), Dave Roelofs (Wildlife Biologist, Butte Falls Resource Area, Medford District BLM) and Steve Godwin (Wildlife Biologist, Ashland Resource Area, Medford District BLM). We also thank the Rogue River-Siskiyou and Fremont-Winema National Forest Supervisors Offices', the Regional Office of the U.S. Forest Service, and the Klamath Falls, Roseburg, and the Portland Offices' of the U.S. Fish and Wildlife Service for their support. We thank the Medford Interagency Office and Medford District BLM for providing work space and logistical support in 2014.

## **9. Research Plans for FY 2015:**

- a) Continue data collection on occupancy, survival, and reproductive success of northern spotted owls on the southern Oregon Cascades Demographic Study Area.
- b) Continue the collection of pellets and analysis of spotted owl diets.
- c) Continue preparation of manuscripts relating to spotted owl nesting sites and diets.

**10. Manuscripts in FY 2014**

- a) Dugger, K.M., E.D. Forsman, D.A. Clark, R.J. Davis, A.B. Franklin, G.C. White, C.J. Schwartz, K.P. Burnham, J. Nichols, J.E. Hines, P. Doherty, L. Bailey, C. Yackulc, S.H. Ackers, S. Andrews, B. Augustine, B.L. Biswell, J. Blakesley, P.C. Carlson, M. Clement, L.V. Diller, E.M. Glenn, A. Green, S.A. Gremel, D.A. Herter, M. Higley, R.B. Horn, K. Huyvaert, C. McCafferty, T. McDonald, K. McDonnell, G.S. Olson, J.A. Reid, J. Rockweit, V. Ruiz, J. Saenz, and S.G. Sovern. *In Prep.* Long-term population demographics of northern spotted owls: 20 years after adoption of the Northwest Forest Plan. 99pp. Intended Outlet: The Condor.

**11. Technology Transfer Completed in FY 2014:**

- a) K. Dugger sponsored and coordinated the 2014 Northern Spotted Owl Range-wide Demographic Workshop, LaSalle Stewart Center, Oregon State University, Corvallis, Oregon, January 6-10, 2014.
- b) As the crew leader presenting the Southern Oregon Cascades Demographic Study Area, L.S. Andrews participated in the 2014 Northern Spotted Owl Range-wide Demographic Workshop, LaSalle Stewart Center, Oregon State University, Corvallis, Oregon, January 6-10, 2014.
- c) K. Dugger and L.S. Andrews provided advisement and technical assistance to T. Tippin for the completion of a Seniors Thesis in fulfillment of the requirements towards a Bachelor of Science Degree at Southern Oregon University.
- d) Project personnel provided the USDA-USFS Ranger Districts, USDI-BLM Resource Areas, and USDI-Crater Lake National Park with information in preparation of the meta-analysis workshop and coordinated surveys.

**13. Duration of the Study:**

- a) Initiated in 1990.
- b) This project is part of the long-term *Northern Spotted Owl Effectiveness Monitoring Program for the Northwest Forest Plan* (Lint *et al.* 1999).

**14. Literature Cited:**

Anderson, D. R., and K. P. Burnham. 1992. Demographic analysis of Northern Spotted Owl populations. Pp. 66–75 in USDI Fish and Wildlife Service. Final draft recovery plan for the Northern Spotted Owl. Volume 2. USDI Fish and Wildlife Service, Region 1, Portland, OR.

Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J. Nichols, J. Hines, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutierrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid, and S.G. Sovern. 2006. Status and trends in demography of Northern Spotted Owls, 1985-2003. Wildlife Monographs No. 163: 1-48.

- Burnham, K.P., D.R. Anderson, and G. C. White. 1994. Estimation of vital rates of the Northern Spotted Owl. Pp. 1–26 in Appendix J of the Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the Northern Spotted Owl. Volume 2. USDA Forest Service and USDI Bureau of Land Management, Portland, OR.
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Appendix 1. Number of northern spotted owl sites surveyed and their respective occupancy on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014<sup>a</sup>.

Year	# Sites Surveyed	# Sites w/ Pairs	# Sites w/ Single Owls	# Sites w/ Social Status Unknown <sup>b</sup>	Total Occupied Sites	# of Sites Unoccupied <sup>c</sup>	% Sites Occupied
1990	78	54	6	11	71	7	91
1991	123	81	5	22	108	15	88
1992	138	107	3	14	124	14	89
1993	126	78	9	22	109	17	86
1994	120	80	4	14	98	22	81
1995	97	62	8	14	84	13	87
1996	91	65	4	7	76	15	84
1997	90	58	4	11	73	17	81
1998	91	67	2	8	77	14	85
1999	81	58	7	5	70	11	86
2000	126	55	10	16	81	45	64
2001	149	80	1	18	99	50	66
2002	161	83	11	17	111	50	69
2003	165	91	5	14	110	55	67
2004	165	73	1	17	91	74	55
2005	167	87	7	17	111	56	66
2006	166	76	9	15	100	66	60
2007	168	79	4	11	94	74	56
2008	169	48	10	23	81	88	48
2009	169	57	5	13	75	94	44
2010	170	60	2	17	79	91	46
2011	170	51	3	11	65	105	38
2012	170	44	11	15	71	99	42
2013	171	36	4	20	60	111	35
2014	171	36	5	12	53	118	31

<sup>a</sup> All sites which were surveyed to protocol; status as determined by protocol (Forsman 1995).

<sup>b</sup> Sites with a response by a male and/or female that did not meet pair or single status with  $\geq 3$  night visits.

<sup>c</sup> A minimum of 3 nighttime visits without a detection was needed to infer unoccupied status.

Appendix 2. Number of spotted owl sites surveyed to protocol and their respective occupancies by Land-use Allocation on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2014<sup>a</sup>.

Land-Use Allocation <sup>b</sup>	Year	# Sites Surveyed	# Sites w/ Pairs	# Sites w/ Single Owls	# Sites w/ Social Status Unknown	Total Occupied Sites	# Sites Unoccupied	% Sites Occupied
<u>Matrix</u>								
	1997	28	20	0	4	24	4	86
	1998	24	18	0	1	19	5	79
	1999	20	17	0	2	19	1	95
	2000	38	17	1	5	23	15	61
	2001	46	22	1	5	28	18	61
	2002	50	24	4	7	35	15	70
	2003	52	28	0	6	34	18	65
	2004	53	22	0	8	30	23	57
	2005	53	28	1	5	34	19	64
	2006	53	23	0	4	27	26	51
	2007	53	23	3	2	28	25	55
	2008	53	15	4	8	27	26	51
	2009	53	17	1	2	20	33	38
	2010	53	15	2	4	21	32	40
	2011	53	15	2	2	19	34	36
	2012	53	15	2	3	20	33	38
	2013	54	13	1	6	20	34	37
	2014	54	12	1	1	14	40	26
<u>LSR</u>								
	1997	53	34	3	6	43	10	81
	1998	58	40	2	7	49	9	84
	1999	52	37	6	2	45	78	87
	2000	79	32	9	9	50	29	63
	2001	86	49	0	12	61	25	71
	2002	94	51	6	10	67	27	71
	2003	95	52	4	6	62	33	65
	2004	95	42	0	9	51	44	53
	2005	96	51	4	9	64	32	67
	2006	96	45	8	10	63	33	66
	2007	98	47	1	9	57	41	58
	2008	98	26	5	14	45	53	46
	2009	98	36	2	11	49	49	50
	2010	99	40	0	11	48	51	52
	2011	99	32	1	9	42	57	42
	2012	99	26	7	11	44	55	44
	2013	99	19	3	12	34	65	34
	2014	99	19	4	11	34	65	34

Cont.

<b>Land-Use Allocation</b>	<b>Year</b>	<b># Sites Surveyed</b>	<b># Sites w/ Pairs</b>	<b># Sites w/ Single Owls</b>	<b># Sites w/ Social Status Unknown</b>	<b>Total Occupied Sites</b>	<b># Sites Unoccupied</b>	<b>% Sites Occupied</b>
<u>Wilderness</u>								
	1997	9	4	1	1	6	3	67
	1998	9	9	0	0	9	0	100
	1999	9	4	1	1	6	3	67
	2000	9	6	0	2	8	1	89
	2001	17	9	0	1	10	7	59
	2002	17	8	1	0	9	8	53
	2003	18	11	1	2	14	4	78
	2004	17	9	1	0	10	7	59
	2005	18	8	2	3	11	5	71
	2006	17	8	1	1	10	7	59
	2007	17	9	0	0	9	8	53
	2008	18	7	1	1	9	9	50
	2009	18	4	1	1	6	12	33
	2010	18	5	0	2	7	11	39
	2011	18	4	0	0	4	14	22
	2012	18	4	2	1	7	11	39
	2013	18	4	0	2	6	12	33
	2014	18	5	0	0	5	13	28

<sup>a</sup> See Table 1 for column heading definitions.

<sup>b</sup> See the Northwest Forest Plan (1994) for a description of Matrix and LSR Land-use Allocations.

Appendix 3. Summary of reproductive success of northern spotted owls on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014<sup>a</sup>.

Year	# Pairs Checked	# Pairs Fledging Young	# Young Fledged	% Pairs Producing Young	Average # of Young/ Successful Pair	Average # of Young/Pair
1990	32	18	26	56	1.44	0.81
1991	44	17	26	39	1.53	0.59
1992	75	55	112	73	2.04	1.49
1993	58	11	16	19	1.45	0.28
1994	70	35	64	50	1.83	0.91
1995	46	14	22	30	1.57	0.48
1996	61	30	45	49	1.50	0.74
1997	46	12	18	26	1.50	0.39
1998	61	32	44	53	1.38	0.72
1999	50	7	12	14	1.71	0.24
2000	49	34	59	69	1.74	1.20
2001	76	11	18	15	1.64	0.24
2002	74	51	96	69	1.88	1.30
2003	82	23	39	28	1.70	0.48
2004	73	56	105	77	1.88	1.44
2005	80	23	31	29	1.35	0.39
2006	74	19	30	26	1.58	0.41
2007	74	41	67	55	1.63	0.91
2008	44	1	1	2	1.00	0.02
2009	53	27	49	51	1.81	0.92
2010	60	29	48	48	1.66	0.80
2011	49	6	9	12	1.50	0.18
2012	44	15	22	34	1.47	0.50
2013	31	8	13	26	1.63	0.42
2014	35	28	47	80	1.68	1.34

<sup>a</sup> All sites which were surveyed to reproductive protocol (Forsman 1995).

Appendix 4. Summary of reproductive success for northern spotted owls, by Land-use Allocation, on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1997-2014<sup>a</sup>.

Land-Use Allocation <sup>b</sup>	Year	# Pairs Checked	# Pairs Fledging Young	# Young Fledged	% Pairs Percent Producing Young	Average # of Young/Successful Pair	Average # of Young/Pair	Average # of Young/All Females
<u>Matrix</u>								
	1997	17	6	9	35	1.50	0.53	0.529 (17)
	1998	16	10	13	63	1.30	0.81	0.750 (16)
	1999	15	6	10	40	1.67	0.67	0.667 (15)
	2000	14	7	11	50	1.57	0.79	0.786 (14)
	2001	20	4	6	20	1.50	0.30	0.286 (21)
	2002	22	12	24	55	2.00	1.09	1.091 (22)
	2003	23	6	11	26	1.83	0.48	0.458 (24)
	2004	22	18	32	82	1.78	1.46	1.318 (22)
	2005	28	8	10	29	1.25	0.36	0.333 (30)
	2006	22	6	10	27	1.67	0.46	0.435 (23)
	2007	20	11	19	55	1.72	0.95	0.905 (21)
	2008	14	0	0	0	NA	0.00	0.000 (17)
	2009	17	11	20	65	1.82	1.18	1.111 (18)
	2010	15	7	12	47	1.71	0.80	0.750 (16)
	2011	15	3	4	20	1.33	0.26	0.267 (15)
	2012	14	5	7	37	1.40	0.50	0.538 (13)
	2013	12	2	3	17	1.50	0.25	0.250 (12)
	2014	12	9	15	75	1.67	1.25	1.250 (12)
<u>LSR</u>								
	1997	27	6	9	22	1.50	0.33	0.333 (27)
	1998	37	21	30	57	1.43	0.81	0.811 (37)
	1999	32	1	2	3	2.00	0.06	0.065 (32)
	2000	29	23	40	79	1.74	1.38	1.333 (30)
	2001	47	7	12	15	1.71	0.26	0.255 (47)
	2002	45	33	60	73	1.82	1.33	1.333 (45)
	2003	48	15	25	31	1.67	0.52	0.520 (48)
	2004	42	30	58	71	1.93	1.38	1.381 (42)
	2005	45	12	18	27	1.50	0.40	0.400 (45)
	2006	44	12	18	27	1.50	0.41	0.382 (47)
	2007	46	28	45	61	1.61	0.98	0.900 (50)
	2008	23	1	1	4	1.00	0.04	0.040 (25)
	2009	32	14	26	44	1.86	0.81	0.788 (33)
	2010	40	21	32	53	1.52	0.80	0.850 (40)
	2011	30	3	5	10	1.67	0.17	0.167 (30)
	2012	26	9	13	35	1.44	0.50	0.500 (26)
	2013	15	6	10	40	1.67	0.67	0.625 (16)
	2014	19	18	30	95	1.67	1.58	1.500 (20)

Cont.

Land-Use Allocation	Year	# Pairs Checked	# Pairs Fledging Young	# Young Fledged	% Pairs Producing Young	Average # of Young/Successful Pair	Average # of Young/Pair	Average # of Young/Female
<u>Wilderness</u>								
	1997	3	0	0	0	NA	0.00	0.000 (3)
	1998	8	2	2	25	1.00	0.25	0.250 (8)
	1999	3	0	0	0	NA	0.00	0.000 (3)
	2000	6	4	8	67	2.00	1.33	1.333 (6)
	2001	8	0	0	0	NA	0.00	0.000 (8)
	2002	7	6	12	86	2.00	1.71	1.714 (7)
	2003	11	2	3	18	1.50	0.27	0.250 (12)
	2004	9	9	15	100	1.67	1.66	1.667 (9)
	2005	7	3	3	43	1.00	0.43	0.375 (8)
	2006	8	1	2	13	2.00	0.25	0.250 (8)
	2007	8	2	3	25	1.50	0.38	0.375 (8)
	2008	6	0	0	0	NA	0.00	0.000 (7)
	2009	4	2	3	50	1.50	0.75	0.750 (4)
	2010	5	1	2	20	2.00	0.40	0.400 (5)
	2011	4	0	0	0	NA	0.00	0.000 (4)
	2012	4	1	2	25	2.00	0.50	0.400 (5)
	2013	4	0	0	0	NA	0.00	0.000 (4)
	2014	4	1	2	25	2.00	0.50	0.500 (4)

<sup>a</sup> All sites which were surveyed to reproductive protocol (Forsman 1995).

Appendix 5. Age and sex of northern spotted owls detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014<sup>a</sup>.

Year	Adults (M,F)	Subadults (M,F)	Age Unknown (M,F)	Age Combined (M,F)	All Juveniles	Subadults (%)	Males (%)
1990	54 (30,24)	2 (1,1)	96 (53,43)	152 (84,68)	26	4	55
1991	112 (58,54)	7 (3,4)	84 (46,38)	203 (107,96)	33	6	53
1992	139 (77,62)	8 (4,4)	97 (46,51)	244 (127,117)	121	5	52
1993	136 (76,60)	12 (5,7)	46 (24,22)	194 (105,89)	16	8	54
1994	139 (73,66)	11 (7,4)	31 (17,14)	181 (97,84)	66	7	54
1995	126 (64,62)	9 (7,2)	16 (12,4)	151 (83,68)	24	7	55
1996	123 (61,62)	5 (4,1)	17 (10,7)	145 (75,70)	46	4	52
1997	114 (63,51)	7 (2,5)	16 (9,7)	137 (74,63)	18	6	54
1998	133 (70,63)	4 (3,1)	22 (14,8)	159 (87,72)	45	3	55
1999	122 (71,51)	7 (1,6)	15 (9,6)	144 (81,63)	12	5	56
2000	111 (65,46)	10 (2,8)	22 (16,6)	143 (83,60)	59	8	58
2001	151 (80,71)	10 (4,6)	25 (20,5)	186 (104,82)	18	6	56
2002	157 (86,71)	13 (5,8)	27 (17,10)	197 (108,89)	98	8	55
2003	168 (90,78)	13 (2,11)	21 (15,6)	202 (107,95)	39	7	53
2004	140 (71,69)	11 (5,6)	23 (15,8)	174 (91,83)	106	7	52
2005	157 (78,79)	19 (11,8)	30 (20,10)	206 (109,97)	32	11	53
2006	145 (78,67)	18 (9,9)	21 (13,8)	184 (100,84)	31	11	54
2007	151 (76,75)	7 (2,5)	20 (13,7)	178 (91,87)	67	4	51
2008	101 (55,46)	7 (2,5)	23 (13,10)	131 (70,61)	1	6	54
2009	115 (60,55)	2 (1,1)	16 (7,9)	133 (68,65)	49	2	51
2010	116 (58,58)	10 (7,3)	22 (13,9)	148 (78,70)	48	7	53
2011	97 (50,47)	4 (3,1)	15 (8,7)	116 (61,55)	10	3	53
2012	98 (55,43)	3 (3,0)	22 (12,10)	123 (70,53)	22	5	54
2013	68 (35,33)	6 (4,2)	27 (14,13)	101 (53,48)	13	8	53
2014	74 (39,35)	6 (4,2)	11 (7,4)	91 (50,41)	47	7	55

<sup>a</sup>Not included are age and sex unknown owls.

Appendix 6. Number of spotted owls newly banded, re-sighted, and recaptured on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 2014.

Age class	Owls newly banded			Owls re-sighted			Owls recaptured		
	Males	Females	Unk.	Males	Females	Unk.	Males	Females	Unk.
Adults	2	1	0	20	24	0	1	2	0
Subadults	1	2	0	0	0	0	1	0	0
Juveniles	-	-	35	-	-	-	-	-	-